

## Claims

What is claimed is:

- 1           1.     A method for implementing automated electronic package  
2 transmission line characteristic impedance verification comprising the steps  
3 of:  
4           generating a selected frequency coupled to a transmission line test  
5 structure;  
6           measuring an input impedance with an open-circuit termination and a  
7 short-circuit termination on said transmission line test structure;  
8           using said input impedance measured value for said open-circuit  
9 termination and said short-circuit termination, calculating characteristic  
10 impedance; and  
11           comparing said calculated characteristic impedance with threshold  
12 values for verifying acceptable electronic package transmission line  
13 characteristic impedance.
- 1           2.     A method for implementing automated electronic package  
2 transmission line characteristic impedance verification as recited in claim 1  
3 includes the steps of providing a pair of transmission line test structures  
4 respectively implemented at a package level with a open-circuit termination  
5 and a short-circuit termination.
- 1           3.     A method for implementing automated electronic package  
2 transmission line characteristic impedance verification as recited in claim 2  
3 wherein the steps of measuring said input impedance with said open-circuit  
4 termination and said short-circuit termination for said transmission line test  
5 structure includes the steps of providing open-circuit impedance measuring  
6 circuitry coupled to one of said pair of transmission line test structures; and  
7 providing short-circuit impedance measuring circuitry coupled to another of  
8 said pair of transmission line test structures.

1           4.     A method for implementing automated electronic package  
2 transmission line characteristic impedance verification as recited in claim 1  
3 includes the steps of providing a single transmission line test structure  
4 implemented at a package level and providing open-circuit and short-circuit  
5 termination circuitry coupled to said single transmission line test structure.

1           5.     A method for implementing automated electronic package  
2 transmission line characteristic impedance verification as recited in claim 4  
3 wherein the steps of measuring said input impedance with said open-circuit  
4 termination and said short-circuit termination for said transmission line test  
5 structure includes the steps of sequentially providing an open-circuit  
6 termination and a short-circuit termination to said single transmission line  
7 test structure utilizing said open-circuit and short-circuit termination circuitry.

1           6.     A method for implementing automated electronic package  
2 transmission line characteristic impedance verification as recited in claim 1  
3 includes the steps of displaying a pass or fail result responsive to said  
4 compared values.

1           7.     Apparatus for implementing automated electronic package  
2 transmission line characteristic impedance verification comprising:  
3           a sinusoidal voltage source coupled to a transmission line test  
4 structure for generating a selected frequency;  
5           impedance measuring circuitry coupled to said transmission line test  
6 structure for measuring an input impedance for an open-circuit termination  
7 and a short-circuit termination;  
8           characteristic impedance calculation circuitry coupled to said  
9 impedance measuring circuitry for receiving said input impedance measured  
10 values with said open-circuit termination and said short-circuit termination for  
11 calculating characteristic impedance;  
12          logic circuitry coupled to said characteristic impedance calculation  
13 circuitry for comparing said calculated characteristic impedance with  
14 threshold values for verifying acceptable electronic package transmission  
15 line characteristic impedance; and  
16          said sinusoidal voltage source, said impedance measuring circuitry,  
17 said characteristic impedance calculation circuitry, and said logic circuitry  
18 being implemented by a single integrated circuit device.

1           8.     Apparatus for implementing automated electronic package  
2 transmission line characteristic impedance verification as recited in claim 7  
3 wherein said transmission line test structure includes a pair of transmission  
4 line test structures respectively implemented at a package level with a open-  
5 circuit termination and a short-circuit termination.

1           9.     Apparatus for implementing automated electronic package  
2 transmission line characteristic impedance verification as recited in claim 8  
3 wherein said impedance measuring circuitry includes an open-circuit  
4 impedance measuring circuitry coupled to one of said pair of transmission  
5 line test structures; and a short-circuit impedance measuring circuitry  
6 coupled to another of said pair of transmission line test structures.

1           10.    Apparatus for implementing automated electronic package  
2 transmission line characteristic impedance verification as recited in claim 7  
3 wherein said transmission line test structure includes a single transmission  
4 line test structure implemented at a package level and an open-circuit and  
5 short-circuit termination circuitry coupled to said single transmission line test  
6 structure.

1           11.    Apparatus for implementing automated electronic package  
2 transmission line characteristic impedance verification as recited in claim 7  
3 includes a display coupled to said logic circuitry for displaying a pass or fail  
4 result responsive to said compared values.

1           12.    Apparatus for implementing automated electronic package  
2 transmission line characteristic impedance verification as recited in claim 7  
3 wherein said characteristic impedance calculation circuitry calculates said  
4 characteristic impedance represented by:  
5  $Z_o = (Z_{sc} \cdot Z_{oc})^{1/2}$   
6 where  $Z_o$  represents said calculated characteristic impedance and  $Z_{oc}$  and  
7  $Z_{sc}$  represent said input impedance measured values for said open-circuit  
8 termination and said short-circuit termination.

1           13.   Apparatus for implementing automated electronic package  
2           transmission line characteristic impedance verification as recited in claim 7  
3           wherein said logic circuitry compares said calculated characteristic  
4           impedance with threshold values for verifying acceptable electronic package  
5           transmission line characteristic impedance represented by:  
6            $Z_1 < Z_o < Z_2$   
7           where  $Z_o$  represents said calculated characteristic impedance and  $Z_1, Z_2$   
8           represent lower and upper threshold values for an electronic package  
9           characteristic impedance specification.

1           14.   Apparatus for implementing automated electronic package  
2           transmission line characteristic impedance verification as recited in claim 7  
3           wherein said transmission line test structure represents conductors on a card  
4           and said single integrated circuit device is disposed on said card.

1           15.   An electronic unit comprising:  
2           a transmission line test structure; and  
3           a single integrated circuit device for implementing automated  
4           electronic package transmission line characteristic impedance verification;  
5           said single integrated circuit device including:  
6           a sinusoidal voltage source coupled to said transmission line test  
7           structure for generating a selected frequency;  
8           impedance measuring circuitry coupled to said transmission line test  
9           structure for measuring an input impedance for an open-circuit termination  
10          and a short-circuit termination;  
11          characteristic impedance calculation circuitry coupled to said  
12          impedance measuring circuitry for receiving said input impedance measured  
13          values with said open-circuit termination and said short-circuit termination for  
14          calculating characteristic impedance;  
15          logic circuitry coupled to said characteristic impedance calculation  
16          circuitry for comparing said calculated characteristic impedance with  
17          threshold values for verifying acceptable electronic package transmission  
18          line characteristic impedance.

1           16.   An electronic unit as recited in claim 15 wherein said  
2           transmission line test structure represents conductors on a card and said  
3           single integrated circuit device is disposed on said card.

- 1           17.    An electronic unit as recited in claim 15 wherein said
- 2           transmission line test structure represents conductors on a multi-chip
- 3           module and said single integrated circuit device is included in said multi-chip
- 4           module.